ACCESS TECHNOLOGIES FOR MACHINE TYPE COMMUNICATION NETWORKS

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Machine-type communication (MTC) has it provides connections for of MTC devices, forming a basis for the Internet of things. Physical layer has a pivotal role in M2M communications. M2M should be made efficient enough in terms of its power consumption and spectrum utilisation for to accommodate a large number of MTC devices. In this work is studied the issues on PHY-layer designs relevant to M2M communications. We surveyed related research works based on MTC network designs and the issues in this respect.

For wireless communications, multiple access technology plays a critical role, which determines how a common medium is shared among users. To develop an optimal air interface supporting M2M traffic, there are numerous features that are unique in MTC, which should be taken into account. As the technical requirements specified in 3GPP LTE-A for the fourth generation of mobile networks and defined by the International Telecommunication Union, downlink data rates need to go up to 100 Mb/s for mobile devices and 1 Gb/s for pedestrial users, respectively.

Based on the vision as proposed by LTE-A (i.e., LTE release 12), HetNets help to enhance the wireless network performance in different aspects. Different transmission devices with different transmission powers and coverage distances between transmitters and receivers pose a big challenge to improve spectrum efficiencies and data transmission rates over different radio links. However, as the number of MTC devices increases, which come with an increasing demand on ubiquitous wireless coverage and high data rates for MTCs, cognitive gateways become an alternative [1]. The use of cognitive gateways in MTC networks promotes a better utilisation of the radio resources (such as an improved spectral reuse factor), because the gateways act as data aggregation points for lowpower and low data rate MTC devices. Nevertheless, the LTE-A standard only defines S1 interface and X2 interface back haul for macro-cells and picocells. For femtocells , it is preferred to use IP as a backhaul protocol .Nevertheless, the existing S1 and X2 interface backhauls in LTE-A do not serve well for the MTC networks, which carry heterogeneous network properties with different cell sizes (such as femtocells and small cells). For this reason, S1 and X2 will not be applicable for MTC, and thus, it is necessary to find a new air-link interface for small-cell environment, which is a vital issue in MTC.

Normally, the transmission links between MTC devices and gateways (also referred to as M2M device grouping issue) play an important role. Moreover, transmission technology from gateways to femtocell (or small-cell AP) is an open issue, which has not been well defined by either 3GPP or other standardisation bodies. Nevertheless, the interference problem caused by multiple paths in HetNets is in particular challenging . In the text followed, we will discuss the interference issues and propose some possible solutions to implement the air-links between MTC devices and gateways.

The macro-cellular networks in LTE are named as evolved NodeBs (eNBs). Using the same backhaul and access schemes as in macro-cells, a picocell is formed by a group of ow-power nodes in HetNets. New Long Term Evolution (LTE)-Advanced features like enhanced inter-cell interference coordination (eICIC) and carrier aggregation (CA). Because of its transmit power ranging from 23 to 30 dBm typically, it covers a distance of 300 m or less for serving for a few tens of users [2]. Femtocell base stations are intended for indoor deployments with their transmit powers less than 100 mW (or less than 23 dBm) typically . They are used in indoor environments such as homes or enterprises, serving a dozen active users by using consumers' broadband connections, such as cable, fiber or digital subscriber line. We studied the issues on PHY-layer designs relevant to M2M communications. We surveyed related research works based on MTC network designs and discussed the issues in this respect. We gave a brief introduction to the major PHY characteristics of Wi-Fi (IEEE 802.11), Bluetooth (IEEE 802.15.1), Zigbee (IEEE 802.15.4) and SUN (IEEE 802.15.4g) technologies.

In a multi-cell environment, a new air-link design based on CC-CDMA for gateways to small-cell APs (G2S) interface was suggested in this paper as a complement to existing technologies and standards. CC-CDMA was proposed as a candidate to overcome interferences occurred in G2S air-links. We also provided a review on the works on CC-CDMA via discussing the characteristics and properties of CCs.

We identified various challenging or open issues for the implementation of MTC in wireless communication systems .

References

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